Accelerating Geothermal Development in East Africa:

A Multi-Donor Strategy

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Objectives

- **Develop a coordinated approach to donor assistance that leads to the rapid, sustainable, development of geothermal power plants**
- **Ensure all activities have a direct role in bringing geothermal megawatts (MW) online**
- **Reassess current approaches to geothermal development and their effectiveness**

Executive Summary

- Multi-donor strategy for more coordinated development of the geothermal resources in East Africa, with four key purposes:

    1. Identify highest priority countries for donor assistance
    2. Identify and accelerate the development of the highest priority transactions with the strongest likelihood of success
    3. Identify top policy and capacity building activities to advance development of geothermal resources and power projects
    4. Explore development of new financing and risk mitigation schemes

- Joint cooperation between African Development Bank (AfDB), the African Union Commission (AUC), and Power Africa (PA)

- Focus countries—Djibouti, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda
    - AUC (through GRMF and other programs), focuses on 5 additional countries—Burundi, Comoros, Democratic Republic of Congo, Eritrea, Zambia
    - While the initial strategy is limited to six countries, lessons and approaches can be applied to all countries

Overview of Methodology

Map country needs against existing and planned donor activities in the context of common criteria for successful geothermal development

- Set of common criteria based on analysis of successful models for geothermal development on a large scale (e.g., New Zealand, Iceland, Philippines, United States)
- Most criteria apply to any development model (i.e., public sector, private sector, public-private partnership), while others focus on the enabling environment for private or public/private sector development

Methodology: Compilation of Raw Data

Through consultations with over 200 donors, government, and private sector officials, we complied a database of donor activities and completed a needs assessment and ranking for each target country

Example:

Donor Activities

Org	Countr	Recipient	Activity	Value (USD)	Assistance Type
JICA	Kenya	GDC	Capacity strengthening for GDC	$ 18,000,000	Technical Assistance
AfDB	Kenya	Private developer	Partial risk guarantee for steamfield and off-take at Menengai	$ 22,815,221	Risk mitigation
Iceland	Kenya	GDC	GDC capacity building at Menengai	$ 1,500,000	Technical Assistance
EIB	Kenya	Private developer	Plant finance for Olkaria I, units 4&5--280MW	$ 137,000,000	Financing
AFD	Kenya	Private developer	Partial financing of 35MW generation capacity at Olkaria III	$ 20,550,000	Financing
KfW	Kenya	KenGen	Olkaria IV appraisal drilling (up to 6 wells)	$ 14,522,000	Financing
WB	Kenya		Financing of 280 MW project, transmission, technical assistance	$ 330,000,000	Financing

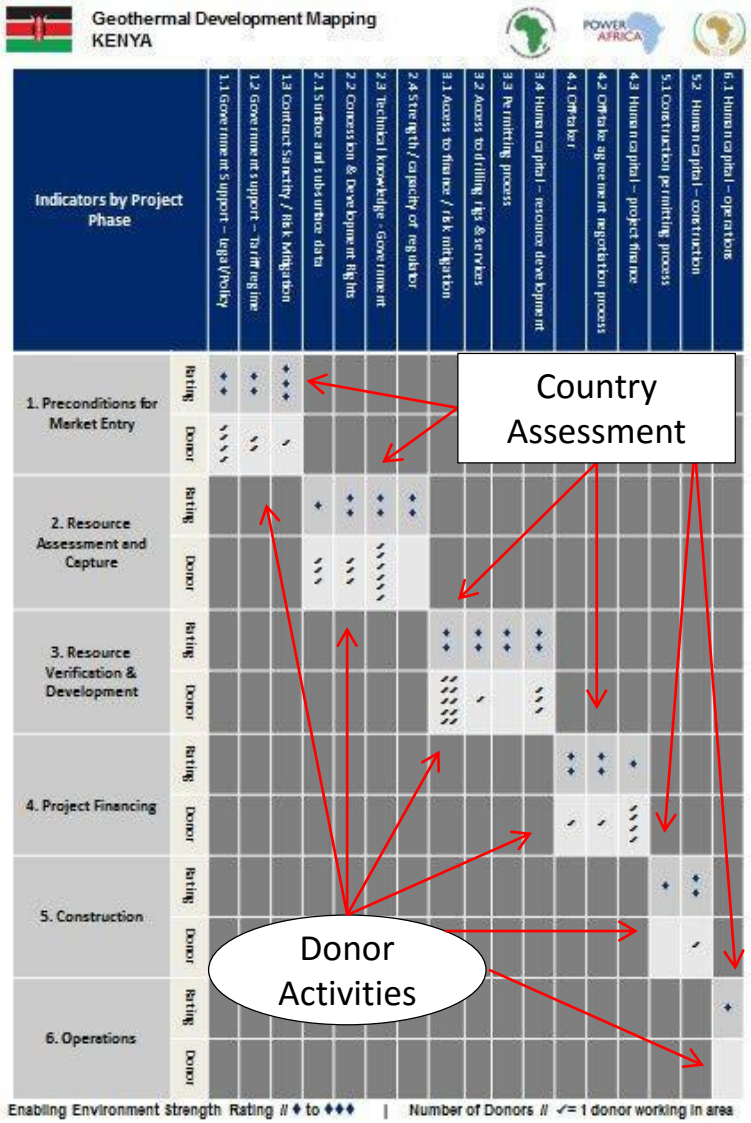
KENYA

Estimated Size of Resource: 8,000-15,000 MW MW Currently Online: ~250MW

Indicator	Notes	Assessment
1. Preconditions for Market Entry		
Government Support – Legal / Policy	• Policy, legal and regulatory framework is generally favorable to IPPs; Kenya booked US$127 million in private participation in power in 2009; US$170 million in 2011 and US$252 million in 2012. Geothermal Resources Act of 1982 and its supplementary legislation of 1990 as well as the Environmental Management and Coordination Act of 1999 with its associated regulations are the legal basis for geothermal power plant implementation in Kenya. There are other laws and regulations that do not directly apply to geothermal but their implications affect geothermal development at various stages and in various ways.	Medium

Needs Assessment & Ranking

Methodology: Mapping



- Donor activities and country assessments were combined to show gaps and areas where coordination may be needed
- This analysis was used to prioritize areas for assistance and rank countries according to their resource opportunities and enabling environment for geothermal development

Reassessing current approaches and assumptions

Approach	Assumption	Reality
Government develops and operates steamfield	• Private developers will not bear the financial and technical risk, so the government must lead development	• Developers will bear risk; tariffs, financing/ risk mitigation mechanisms, and policy clarity will drive development • Government guarantee of steam supply for life of project means IPPs not in control of the fuel source; governments incur significant liability on their balance sheets
	• This approach will result in lower tariffs	• Lower tariffs may not be economical for IPPs; government portion of the tariff may not be truly cost reflective; hidden subsidies likely exist, putting further financial pressure on government balance sheets
	• Governments need to develop the in-house capacity to develop and manage steamfields	• *Can* make sense for countries with significant resources (Kenya and Ethiopia); in countries with lower MW potential; not a good use of resources • Project management expertise is critically needed; however, important to calibrate level of expertise needed
Government conducts exploratory drilling; tenders PPP	• By doing the exploration drilling, governments will be able to command higher prices for tenders	• Most developers discount data provided by governments unless it meets international standards; even then, it is unlikely to command a premium, as developers will likely conduct their own exploration

Country Rankings

Rankings emphasized:

- Government policies and support for private sector geothermal development
- Overall environment for doing business in the country
- Clear processes for developing and operating geothermal plants
- Off-take (clarity of process, trends in pricing)
- Resource potential

Which countries have the most promising environment for private sector developers?

	1. Preconditions for market entry				2. Resource Assessment and Capture				3. Resource Verification and Development				4. Project Financing			5. Construction		6. Operations		
Indicators by Project Phase	1.1	1.2	1.3	1.3a	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	6.1	Score	RANK
Multiplier	3	2	4	1	1	2	1	1	2	1	2	1	2	2	1	1	1	1		
KENYA	♦♦	♦♦	♦♦♦	♦♦♦	♦	♦♦	♦♦	♦♦	♦♦	♦♦♦	♦♦	♦♦♦	♦♦	♦♦	♦	♦	♦♦	♦	61	1
ETHIOPIA	♦♦	♦♦	♦	♦	♦♦	♦	♦♦	♦	♦♦	♦♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦♦	♦	♦	52	2
RWANDA	♦♦	♦	♦♦♦	♦	♦♦	♦	♦♦	♦♦	♦♦	♦	♦	♦♦	♦♦	♦♦	♦♦	♦	♦	♦	50	3
UGANDA	♦	♦♦	♦	♦	♦♦	♦	♦♦	♦♦	♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦♦	♦	♦	♦	43	4
TANZANIA	♦	♦	♦	♦	♦♦	♦	♦	♦♦	♦	♦♦	♦	♦	♦♦	♦♦	♦	♦	♦	♦	36	5
DJIBOUTI	♦	♦	♦	♦	♦♦	♦	♦	♦	♦	♦♦	♦	♦	♦	♦	♦	♦	♦	♦	31	6

Priority Private Sector/PPP Transactions

Rankings emphasized:

- Government policies and support for private sector geothermal development
- Stage of transaction—how far has the project advanced in terms of permitting and exploration?
- Significant role for private sector developer (either 100% private, or PPP with large role for private developer)

Which transactions represent the best opportunity to connect geothermal MW to the grid in 0-5 years?

Top Transactions		
Transaction	**MW Potential**	**Country**
Corbetti	20MW (first phase, with multiple expansion phases)	Ethiopia
Akiira and Agil (Longonot)	Up to 140MW each	Kenya
Menengai	90MW	Kenya
Baringo-Silali	200 MW (first phase)	Kenya
Olkaria VI	TBD	Kenya
Ngozi (Geothermal Power Tanzania)	TBD	Tanzania

Key Recommendations

1. Additional risk mitigation and financing mechanisms to augment existing programs
2. Standardization (where applicable) of acts, policies, and organizational structures
3. Improved data collection
4. Geothermal association and capacity building

Recommendation:
1- Risk Mitigation Facility

- **Across the region, there is a significant need for capital to bridge the risk remaining for production drilling**
  - GRMF, private insurance (e.g. MunichRe), other facilities (Africa Clean Energy Finance Initiative (OPIC), African Legal Support Fund (AfDB)) exist to fund earlier exploration and project setup, but significant risk remains (and capital costs are significant) for production drilling

- **The best type of facility will depend upon:**
  - Level of financial sophistication (financing mechanisms, local and international bank presence, prevalence of project finance)
  - Potential pipeline to diversify risk

- **Options include:**
  - Revolving loan fund
  - “Soft” loans tied to technical assistance for project development and tendering
  - Insurance product
  - Bridge financing for equipment and materials with long procurement cycles

Current Risk Mitigation Options

Program	Description	Surface exploration	Exploration Drilling	Production drilling	Construction	Operations	Transaction costs	Pros	Cons
GRMF	Grant facility to fund early surface and some exploration drilling costs	X	X					•Available to public or private •Many uses	•Annual application cycle •Small facility
ACEF, ALSF	Grant facility to fund early development and transaction costs	X					X	•Mitigates transaction risk •Flexible application	•ACEF limited to US service providers •Small grants
Drilling Insurance: Munich Re	Insurance product for earliest (exploration) drilling risk		X					•Partially insures riskiest wells	•High premium costs •Does not cover production drilling •*Does not address capital needs*
Drilling Insurance: Parhelion (tentative)	*Insurance product to cover some production drilling*			*X*				•*Partially mitigates production drilling risk*	•*Still considerable risk remaining* •*High premium costs* •*Does not address capital needs*
Project Financing	Traditional debt from donors or private lenders				X	X	X	•Low cost capital to bring projects to COD	•Only available after majority of risk mitigated
Private Insurance	Traditional insurance required by project lenders				X	X		•Protection against project delays, performance issues, force majeure	•Only available after majority of risk mitigated
Risk Guarantees	Facilities to mitigate political, performance risk				X	X		•Protection against political, off-take risk etc.	•Mostly available after majority of risk mitigated

Risks/ Financing Gaps Still Remain

Program	Description	Surface exploration	Exploration Drilling	Production drilling	Construction	Operations	Transaction costs	Pros	Cons
GRMF	Grant facility to fund early surface and some exploration drilling costs	X	X					•Availabl[illegible]	[illegible] application cycle
ACEF, ALSF	Grant facility to fund early development and transaction costs	X					X	•Mitigates tra[illegible] •Flexible application	ACEF limited to US service providers •Small grants
Drilling Insurance: Munich Re	Insurance product for earliest (exploration) drilling risk		X						[illegible]sts [illegible]roduction drilling *[illegible] address capital needs*
Drilling Insurance: Parhelion (tentative)	*Insurance product to cover some production drilling*			X				*•Partially mitigates [illegible]*	*•Still considerable risk remaining* *[illegible]ium costs* *[illegible]s capital needs*
Project Financing	Traditional debt from donors or private lenders				X	X	X	proje[illegible]	[illegible]after majority of risk [illegible]gated
Private Insurance	Traditional insurance required by project lenders				X	X		•Protection against project [illegible]	•Only available after majority of risk
Risk Guarantees	Facilities to mitigate political, performance risk				X	X		off-take risk [illegible]	[illegible]ble after majority of risk mitigated

Most products **cover** either **very early stage risk**, or construction and operational risk

There is **still a gap at the riskiest,** most capital intensive **point** of project development

There is also a **lack of bridge financing** to procure long lead items prior to obtaining project debt—this **causes significant project delays**

Insurance products can help mitigate this risk, **but high premiums and the cost of capital are still prohibitive**

Recommendation: 2 - Standardized acts and policies

- **Country assessments revealed numerous gaps in policy development in most countries. Common policies and other contracts and processes could have a regional impact**
- **Time is money for developers: streamline permitting and negotiation process**
- **Key needs identified include:**
  - Geothermal law (or common principles) to be adapted by each country
  - Common documentation for permitting, concession tendering, rig tendering, other procurements, etc.
  - Common PPA, interconnect agreements, steam supply (if applicable), etc.
  - Development of a common/illustrative structure and functions for agencies overseeing geothermal project development
    - Appropriate structure will depend upon resource size, development model(s), and government commitment to geothermal development

Recommendation: 3 - Improved data collection

- **Collection of high quality data in a standardized format is critical at every phase of geothermal power development**

- **Without robust data, it is impossible to:**
  - determine the characteristics of a resource,
  - target production wells,
  - learn from drilling errors,
  - track construction expenses,
  - monitor steamfield performance, etc.
  - obtain higher bids when tendering concessions to private developers

- **A comprehensive study of data collection practices in each country is needed, and should include recommendations to improve the collection, storage and presentation of data**

- **Data collection efforts should support and be integrated with ARGeo Geothermal Inventory Database (AGID)**

Recommendation:
4- Geothermal association & capacity building

- **Potential roles for a geothermal association:**
  - Convene members and key stakeholders to coordinate assistance activities, share insights, and develop common solutions to common problems
  - Provide or coordinate training on geothermal energy and project development topics and help to **build local technical and institutional capacity**
  - Provide guidance to donors, governments, and the private sector on best approaches to geothermal development
  - Preserve and disseminate institutional knowledge: Serve as a repository for information, studies, training materials, reports, industry best practices etc.
  - Advocate on behalf of members at a regional level
  - Share information across the region to facilitate investment and cooperation
  - Provide assistance/guidance to country-level geothermal associations

- **Potential members:**
  - Private sector developers and service providers
  - Government officials working in geothermal power (or renewable energy)
  - Donors
  - Investors, lenders, and other providers of capital for geothermal

Next Steps

- **Circulate executive summary with key counterparts—donors, government officials, and the private sector**

- **<u>Refine and build consensus</u> around key recommendations, country, and transaction priorities**

- **<u>Use strategy in the design, implementation, and coordination of donor assistance</u>**

→ The strategy and its supporting materials (donor project database, country assessments) are <u>intended to be updated at regular intervals</u> as geothermal development moves forward in the region

→ Measure progress towards our goals